



Alstom Grid

SmartGrid Strategic Technologies

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Vice President Strategy & Innovation

We are shaping the future

ALSTOM

Alstom Group Clean Energy and Transport Solutions

Power Generation Thermal & Renewables

Low & No-Carbon Energy Solutions

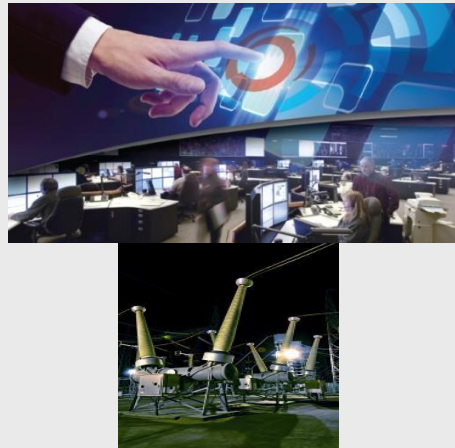
Renewables
Efficiency Improvements
Carbon capture & Storage



Grid

Smarter, more Reliable, more Flexible Power Transmission

Renewable Integration
Advanced Network Management
'Evergreen' Smart Grid Strategy



Transport

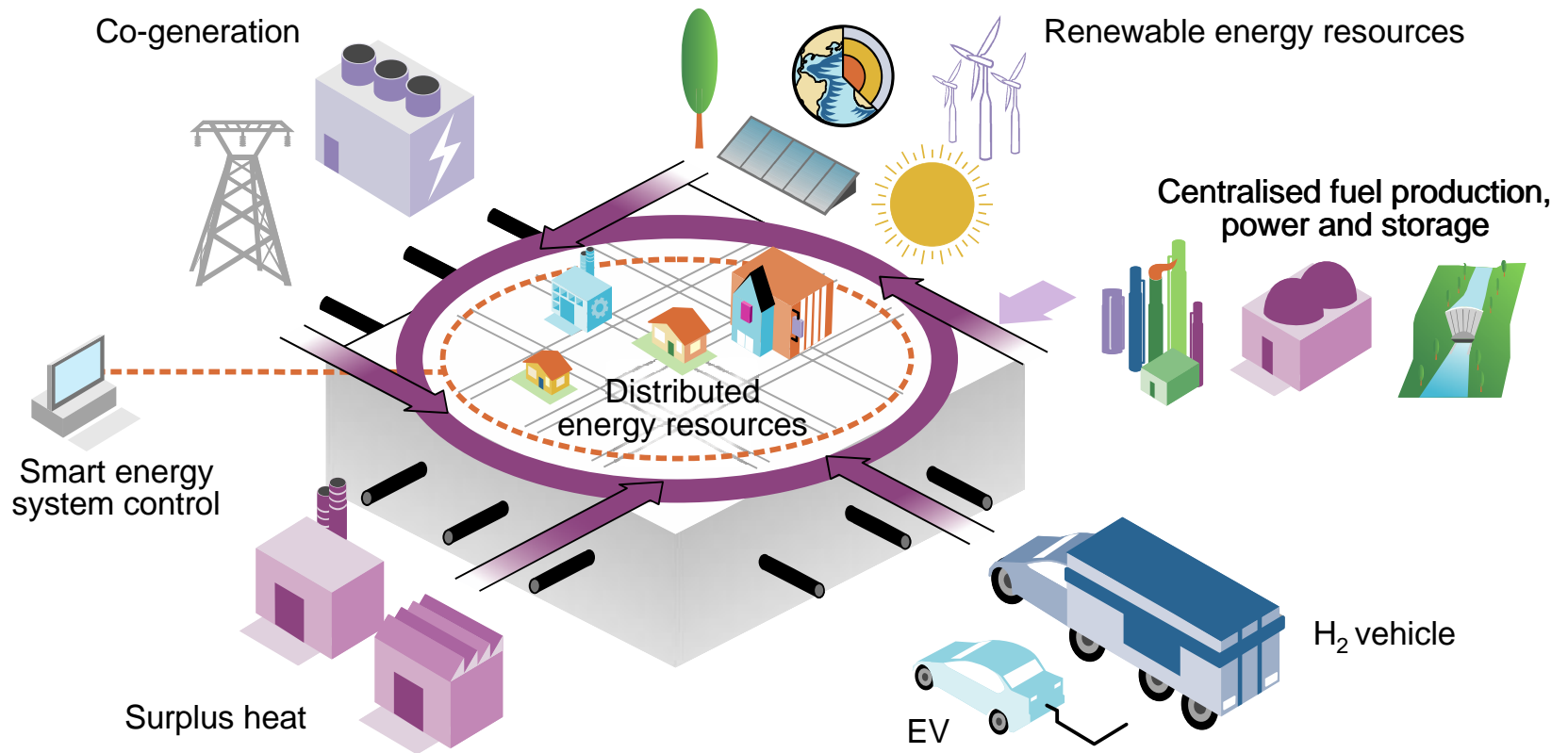
Faster, Cleaner and less congestion

High-speed Rail
Light Rail
Urban Tramways



Energy will become Smart

ETP
2012



A sustainable energy system is a smarter, more unified and integrated energy system



Evolution in Grid Control Architectures



Alstom Grid is strong technology leader in Grid Control with eterra 3.0 & DS Agile



On-Line Stability & Digital SS



Renewable Connection



Demand Response



SmartCity Integration



GRID



Different drivers on geographies



*Renewable excluding Hydro

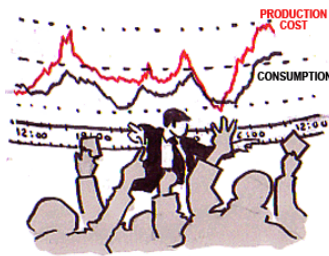


Step Change : Prosumers turning to active energy managers



Putting prosumers at the center of their energy strategy

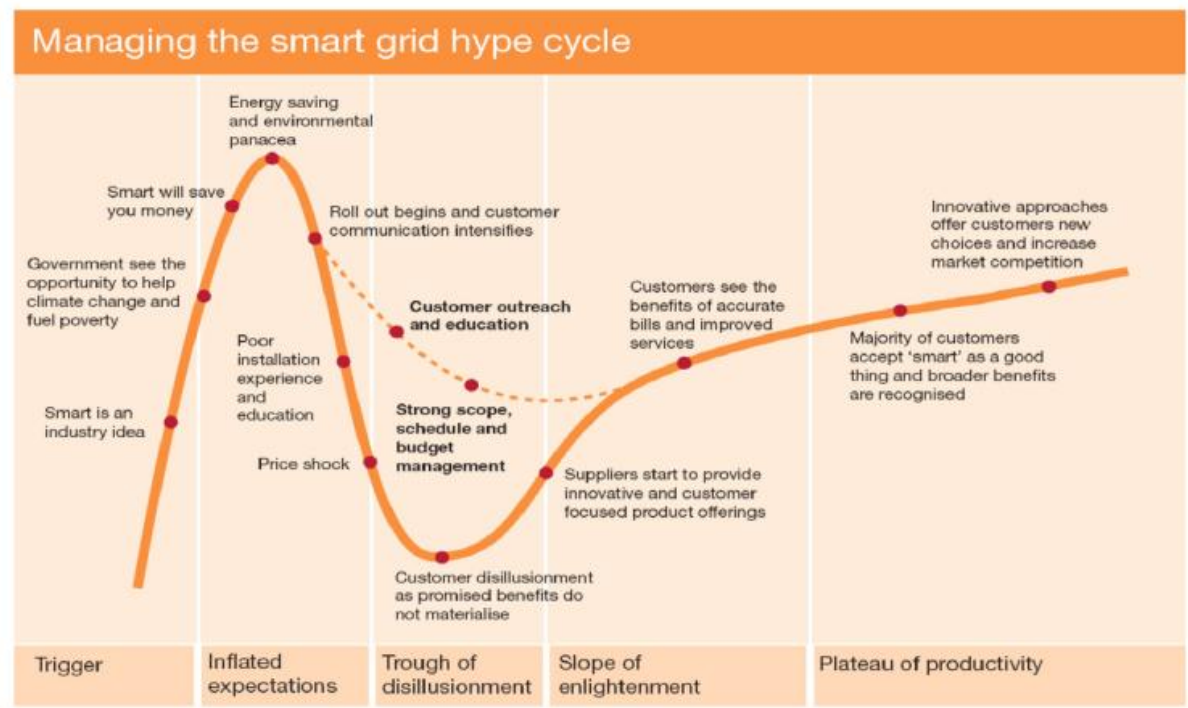
- My choice to differ some of my energy usages
- My choice to share my energy data / utilization patterns
- My choice regarding renewable mix with same reliability of supply
- My arbitration against energy peak prices and emergency grid services
- My choice on which transportation to use (Fuel/electrical)



New IT Connection & real-time interactions

Where is SmartGrid in the Hype Cycle ?

Involving end consumers



Source: "Smart from the Start – Managing Smart Grid Programmes", PwC, 2010

New end to end layered architecture

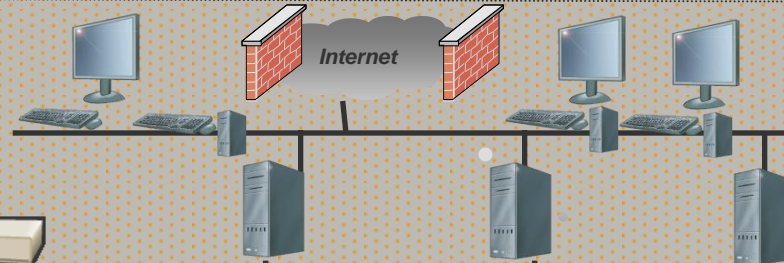


**Transmission/Wholesale
Control Rooms
(EMS-MMS-OSS-AMS-GMS)**



**TSOs & Market
Operators**
**Aggregators
(Generation, Load)**

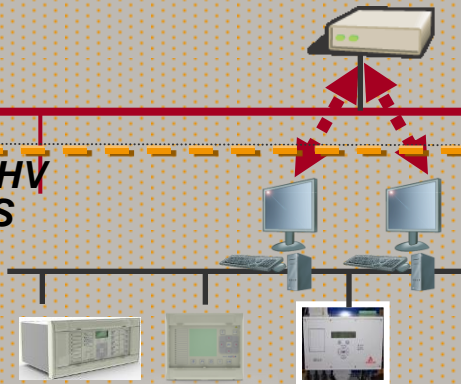
**Distribution/Retail
Control Rooms
(IDMS, DRMS, MDMS)**



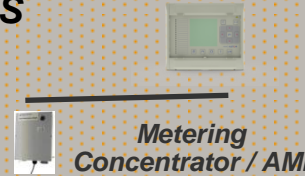
DSOs
Cities
Neighborhoods

**Grid
Automation**

**T EHV
SAS**



**Secondary D
SAS**

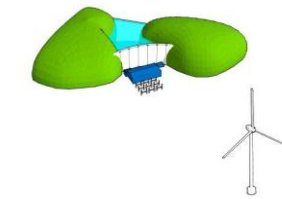


**Sub T / Primary D
SAS**



**Metering
Concentrator / AMI**

**Asset
Automation &
Controls**



Gencos



Storage



Residential



EV



**Commercial &
Industrials**

Different drivers on geographies



*Renewable excluding Hydro



Smart Grid Innovation Roadmap



2011 2012 2013 2014 2015

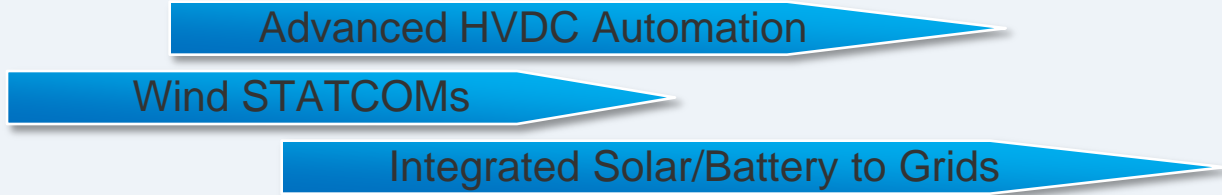
Control room IT



Digital substations



Power electronics



Exemple 1 – Alstom Psymetrix On Line Stability & Defense Plan

Shaping the Smart Grid

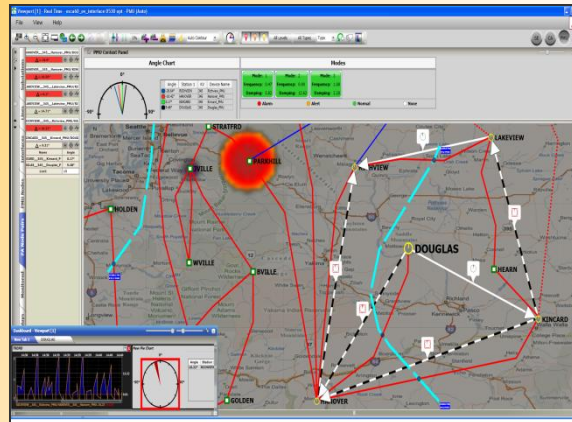
Improve Security

- ◆ EARLY WARNING OF INSTABILITY
- ◆ SITUATIONAL AWARENESS
- ◆ ISLANDING RECOVERY
- ◆ BLACKSTART
- ◆ SELF-HEALING GRID



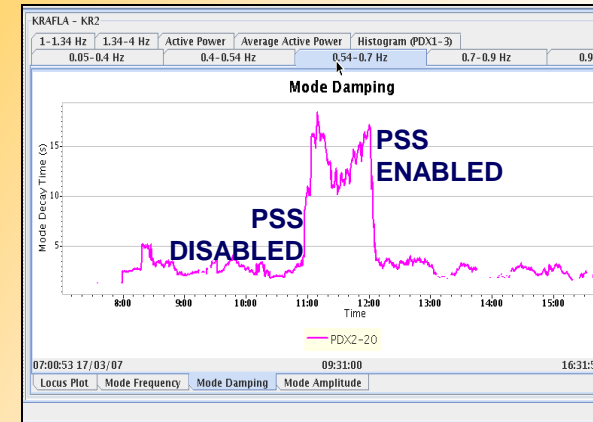
Increase Transfer

- ◆ RELIEVE DAMPING CONSTRAINTS
- ◆ STATE ESTIMATION & CONTINGENCY ANALYSIS
- ◆ IDENTIFY LINE PARAMETERS



System Analysis

- ◆ POWER SYSTEM TUNING
- ◆ PLANT COMMISSIONING
- ◆ POST-EVENT ANALYSIS
- ◆ IMPACT OF RENEWABLES
- ◆ IDENTIFY DYNAMICS ISSUES



Exemple 2 – Alstom UISOL On Line Stability & Defense Plan



PJM as Part of the Eastern Interconnection



21% of U.S. GDP produced in PJM

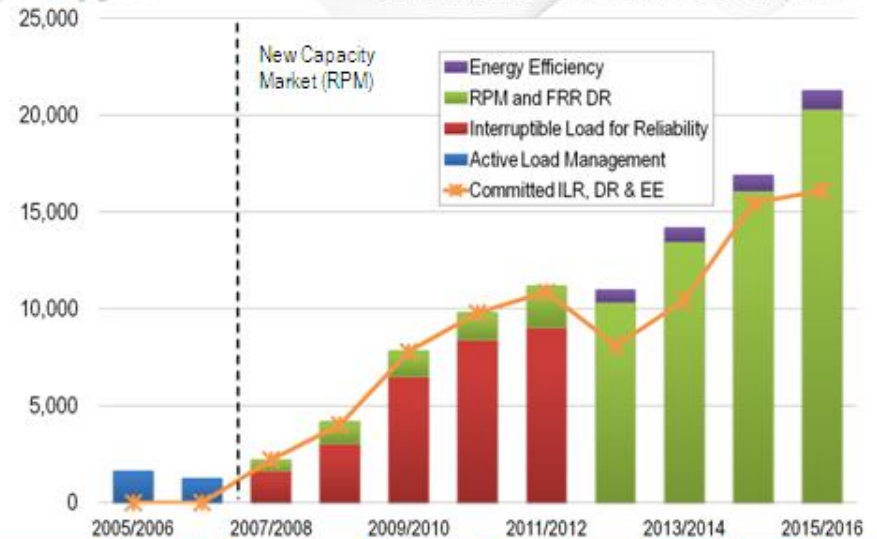
KEY STATISTICS

Member companies	750+
Millions of people served	60
Peak load in megawatts	163,848
MW of generating capacity	185,600
Miles of transmission lines	65,441
GWh of annual energy	832,331
Generation sources	1,365
Square miles of territory	214,000
States served	13 + DC

As of 1/4/2012



Growth of Demand Resources



Over 10 Nuclear Plan equivalent interacting into PJM Market

Exemple 3 – Alstom Digital Substation

Shaping the Smart Grid

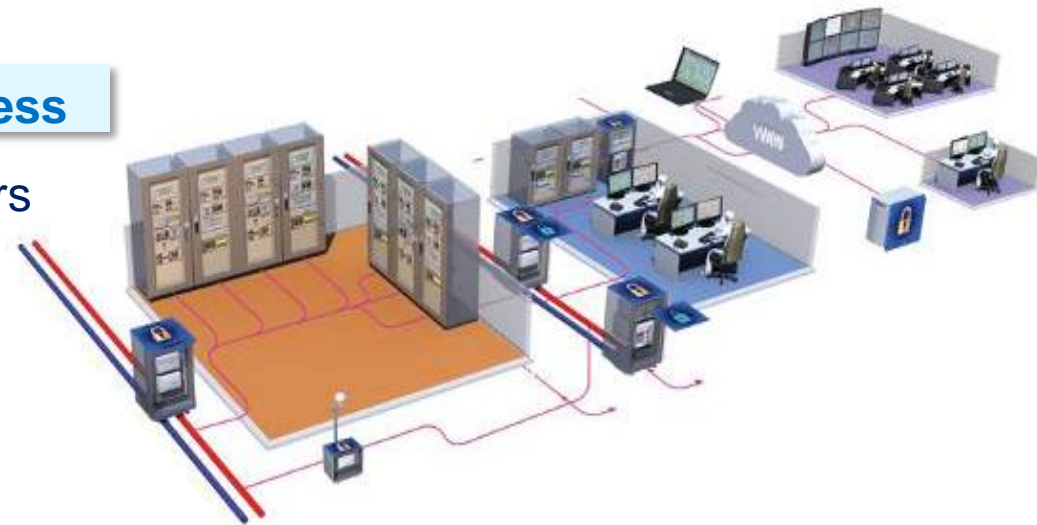
Improved integration with Control Rooms

- Consistent CIM/IEC61850 Standards
- Asset Management Models
- End to end Security architectures



New Substation Situation Awareness

- On-Line Stability on critical Corridors
- Integrated Asset Management
- Strengthened Substation Security
- Digitalisation of all signals



First end to end deliveries with Rte & FSK

Exemple 4 – Alstom Grid Integrated Distribution Management

Shaping the Smart Grid

Outage Time



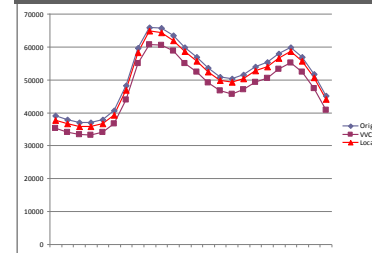
Reduced by 30%

System Loss



Reduced by 5-7%

Peak Load



Shaved by 3-5%

Storm



Ready

Grid Reliability



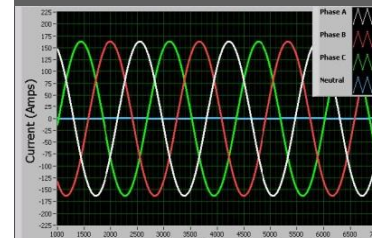
Enhanced

Customer Satisfaction



Enhanced

Power Quality



Enhanced

Crew Safety



Enhanced

Exemple 5 – Alstom Grid – NGK - Saft Grid Scale Storage

Shaping the Smart Grid

Li- Ion

Integrated test with SAFT completed in
July 2012 (France)



Na-S

Integrated test with NKG scheduled
Dec 2012 (Japan)



Exemple 5 – Alstom Grid – Bouygues Virtual Energy Community Management



Connecting and piloting urban energy infrastructures



Generation & storage



Transports
Electrical vehicles



Smart building
management



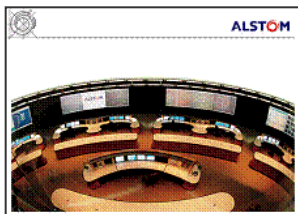
Demand response



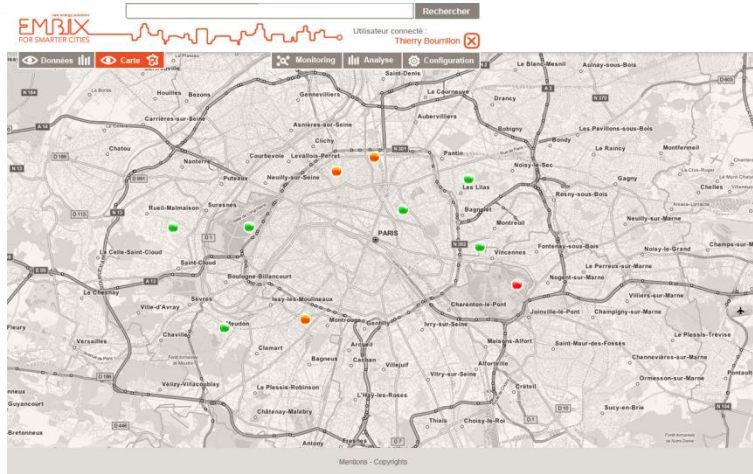
Eco-cities / eco-districts

Distribution Management
Optimized usage of urban energy infrastructures
Carbon footprint measurement

- Interconnecting all urban energy resources (generation & storage, buildings, transports, residential housing, etc.) into a single integrated smart city
- Using smart grid to provide real-time monitoring of specific and overall electricity consumption, generation and carbon footprint



Typical Energy Management Cockpit



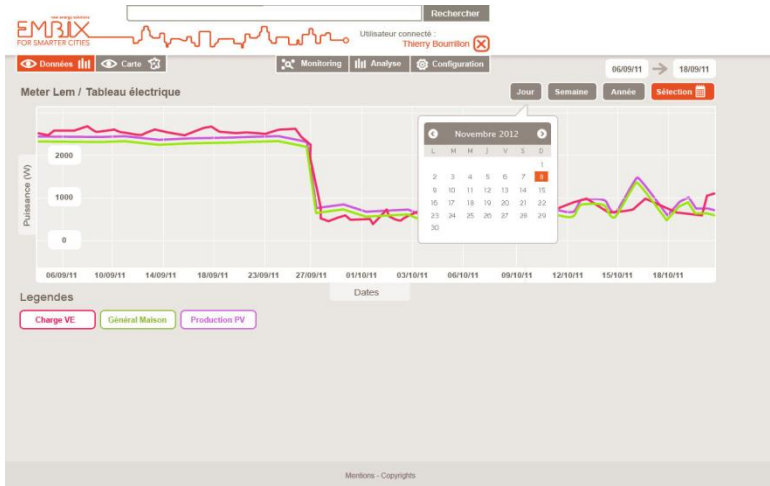
The screenshot shows the ALSTOM Grid reservation interface. It features the ALSTOM Grid logo and the 'Carsharing Services By Alphabet' logo. The main heading is 'ACCUEIL ALSTOM GRID > NOUVELLE RÉSERVATION'. Below this is a 'Module de réservation' section with a search bar and a 'Rechercher sur la carte' button. The reservation details include:

- Formules: A l'heure
- Station: La Defense
- Jour de départ: 22/05/2012
- Heure de départ: 17h30
- km à effectuer: Levallois A/R (10 km)
- Jour de retour: 22/05/2012
- Heure de retour: 20h30

 A 'Rechercher' button is located below the details. Below the reservation details is a table showing reservation information:

Modèle	Capacité	Description	Ville	Parking
Citroën C-ZERO BT 485 VD	4	Grise	ALSTOM Grid	La Defense

 Below the table is a timeline showing the reservation status from 00:00 to 24:00. The status is 'Votre réservation' (green) from 00:00 to 04:00, 'Disponible' (grey) from 04:00 to 16:00, and 'Indisponible' (red) from 16:00 to 24:00. A 'Tarif: A l'heure - Entreprise / Electrique' is indicated. A 'Reserver' button is at the bottom right.



The screenshot shows the IDENHO 'Mon bilan énergie' interface. It features a navigation menu with options like 'ACCUEIL', 'PROFIL', 'CONDOMINIUM', 'APPARELS', 'CONFORT', and 'LABO WPM'. The main heading is 'Mon bilan énergie'. Below this is a section for 'VOTRE USAGE ÉLECTRIQUE | VOTRE LOGEMENT'. The interface displays a bar chart showing energy efficiency metrics, with a score of 9,1 / 10. The chart compares the user's consumption to other users in the area. The text below the chart states: 'Vous vous situez dans les 10% des foyers les plus économes en énergie. Félicitations ! Mais il est toujours possible d'aller plus loin et de consommer mieux.' Below the chart is a section for 'REPARTITION DE VOTRE CONSOMMATION' showing the breakdown of energy consumption by category: Chauffage (75%), Eau chaude (14%), Climatisation (2%), Froid (2%), and Éclairage (0%). A 'MON PROFIL' section provides additional information about the user's home: 'Type: maison individuelle de 160 m²', 'Année de construction: entre 1970 et 2000', 'Nombre de personnes: 4', 'Consommation annuelle: 29 000 kWh (brutes énergies comprises)', and 'Nombre d'appareils électriques: 59'. There are buttons for 'JE CONSULTÉ MES CHALLENGES' and 'JE MODIFIE MON OBJECTIF'.

Pushing for convergence and strategic partnerships



Worldwide

IEA, ISGAN, SGGF



NIST, SGIP, DOE, CIMUsergroup



CEN-CENELEC-ETSI, T&D Europe, SmartCity Platform

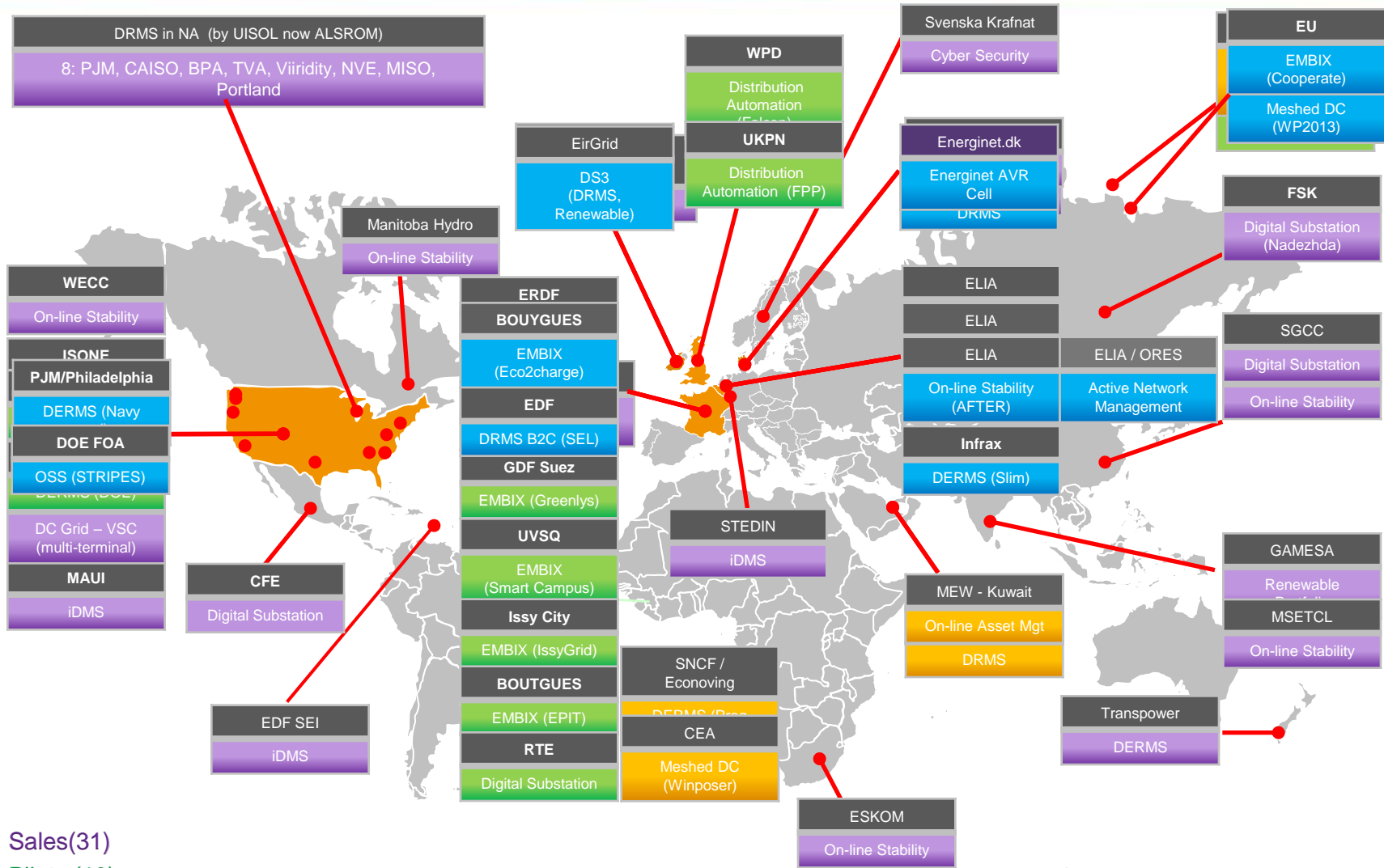
France

Gimmelec, System@tic



Smart Grid

Business Development Map



Sales(31)
 Pilots (13)
 Strategy, Early Concept (12)
 Innovation, Prototype (6)

Reflexe Demonstration

1- Virtual Power Plants



Prédiction et Accroissement du facteur de la Réponse de Flexibilité Electrique pour les réseaux intelligents.

REFLEXE is a demonstrator Funded by ADEME. Its aims at validating the technical feasibility of a commercial virtual power CVPP plant and associated business model.

ALSTOM Grid delivers the IT platform to build, optimize, dispatch and settle the CVPP portfolio

- Hôtels :
Fairmont & MC Bay
- Tertiaire Bureaux :
C2R, RSI, ETSI,
Toyota, Edhec
- Industries :
STEP Draguignan
Réseau d'eau potable
- ERP :
Aéroport de Nice
Parc Azur
Ville & Métropole Nice
- A venir :
• Industries
Centres de tri
Assemblage
Chimie

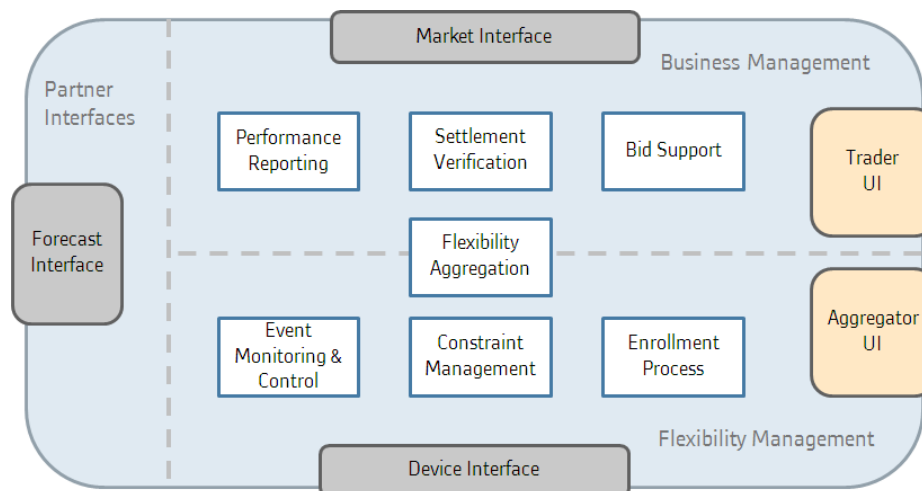
ALSTOM SAGEMCOM



Demonstrator Located in Nice Area

20 Commercial Buildings, 2 Industrial sites, 2 solar farms

1 MW of DR
5 MW of PV



GRID **ALSTOM**

NiceGrid Demonstration

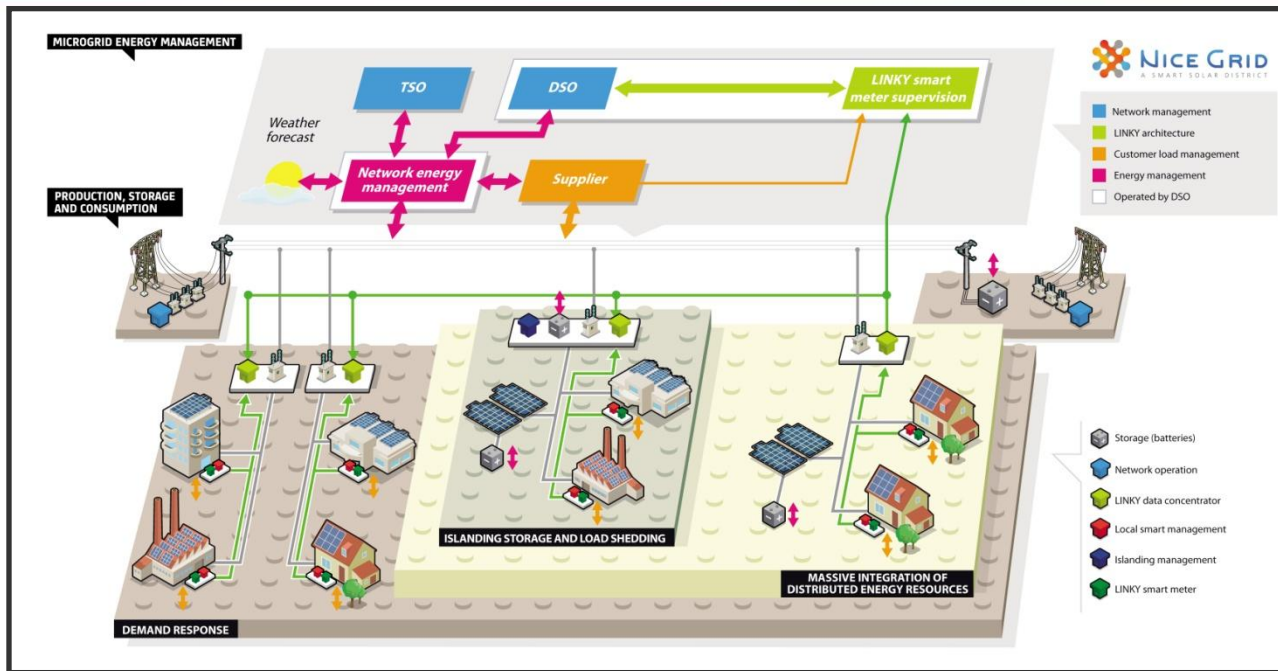
2- Micro grids



NICEGRID is a demonstrator
 Funded by ADEME and FP7. Its
 aims at designing and testing in
 real scale a micro grid with:

- ✓ Massive PV integration at LV
- ✓ Islanding in extreme situations
- ✓ And Demand Response

ALSTOM Grid delivers the
 Network Energy Manager of the
 Micro Grid that is operated by the
 DSO



NiceGrid
 Located in
 commune
 La
 CARROS
 (12,000
 hab)
 TOTAL
 2MwC
 residential
 PV at LV



GRID



IssyGrid Demonstration

3- Integrated EcoDistrict Energy Management

Shaping the Smart Grid

- **Commercial Buildings:**
160 000 m²
- 10 000 employees
- **Residential: 2 000 houses**
- 5 000 inhabitants
- **Public buildings : Schools**

- **Renewable :** PV, cogeneration,
- **Load :** residential, tertiary buildings, commerces
- **Storage :** LI-Ion Batteries
- **Smart Street Lighting**
- **EV Charging Spots,**



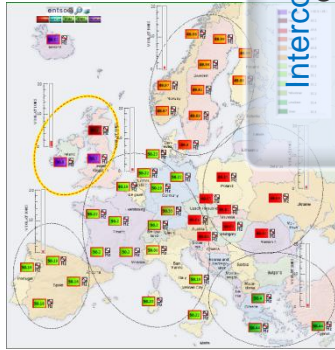
Future Next Generation Market Place

Internal Congestions
More and more complex operational issues to solve on the Grid (AC/DC)

Need to Explicitly take into account models / physics in electricity markets



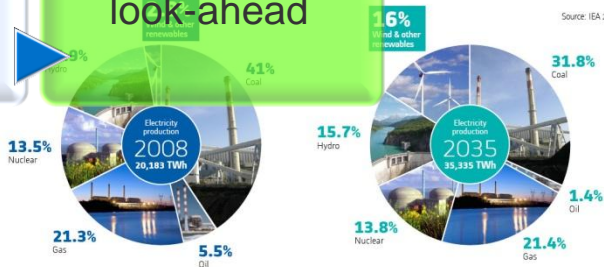
Inc. Interconnections
More and more need for collaboration



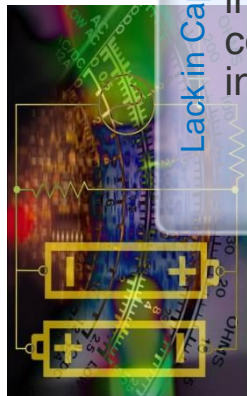
Need Regional coordination for both System and Market operation

Stochastic Power
More and more uncertainties

Need to get Closer to real-time market operation
Importance of look-ahead



Lack in Capacity
Need to provide incentives to cover investments



Importance of regulation
New products (DR, flexibility)
Capacity markets

Need to benefit from latest IT tools

Connecting with external Social Communities

The screenshot shows a web browser window displaying the Facebook page for 'Smart Eco Citizens'. The browser's address bar shows the URL 'https://www.facebook.com/SmartEcoCitizens'. The Facebook interface includes a navigation bar with the user's name 'Laurent Schmitt' and options like 'Voix', 'Retrouver des amis', and 'Accueil'. Below the navigation bar, there are several sections: 'Administration' with options to 'Modifier la Page', 'Développer l'audience', 'Aide', and 'Afficher'; a prompt to 'Lier votre Page à votre compte Twitter'; a large image of a white car with 'ALSTOM' and 'Smart Grid' branding parked in front of a grand building; a smaller image of a smart grid visualization; and a 'Smart Eco Citizens' profile section with 6 likes and 2 people talking. The right sidebar contains 'Votre publicité' with a 'Créer une Page' button and a 'Faites de la publicité pour votre Page' button. The bottom of the browser shows the Windows taskbar with various application icons and the system clock at 09:38.



Welcome in the new interoperable Smart Grid world !